# DECORATIVE HANGING FABRIC PANELS WITH INTEGRATED STIFFENED AREAS

This application claims the benefit of U.S. Provisional Application Ser. No. 60/400,272, filed July 31, 2002.

## BACKGROUND OF THE INVENTION

This invention relates generally to the field of decorative fabric panels, and more particularly to such panels having stiffening members or stiffened areas to stabilize portions of the panel, such as along one or more edges. Even more particularly, the invention relates to such panels that are decorative hanging panels used to cover architectural openings, such as windows, in a manner that allows the panel to be opened and closed as desired.

Decorative hanging panels in the form of blinds, curtains, drapes, room dividers, shower curtains and similar items, are commonly utilized for decoratively covering architectural openings or enclosures such as windows, entryways, wall insets, etc. Most hanging panels require stabilization along their top support edges for functional and/or aesthetic reasons. One way to hang such panels is to provide grommets along their top support edges to receive a support rod or equivalent element inserted in an alternating front-to-back manner through the grommets, thereby creating decorative folds that extend the full vertical length of the panel. Conventional techniques for imparting the requisite structural stability to the support edge of such grommet-supported hanging panels include sewing or otherwise attaching a stiffening tape along the top edge of the panel, or folding the top edge back upon itself one or more times and then stitching it or bonding it with adhesive. Another approach to achieving adequate stability in the top edge entails inserting a stiffener into a pocket formed along the top edge. The resulting structural rigidity stabilizes the top edge to prevent the top edge of the panel from sagging or

bunching, and furthermore maintains consistent material fold alignment in the area between the grommets.

Other types of hanging panels employ hooks, fabric loops (also known as tabs), rings or other securing members to connect the panel to the support element wherein the hooks, fabric loops or tabs are sewn or otherwise attached to the support edge from which the fabric panel hangs. To prevent the top edge from sagging or appearing "crunched" when the panel is expanded or retracted sideways, these types of hanging panels also require top edge stabilization, typically achieved by folding the top edge of the panel multiple times and securing the folded edge by stitching or bonding, such that the multiple layers of fabric provide increased stability.

In louver curtains, a fabric panel with elongated folds is pivotally connected at the top to a plurality of relatively rigid vanes at predetermined spaced intervals. The panel is movable about the vertical axes of the vanes and sidewise on a support element to open and close, constantly forcing the folds into different shapes. To conform the folds in any louver position without distortions, the top of the panel is stabilized by a folding and sewing technique, by heat sealing, or by inserting stiffeners. To establish and preserve the desired elongated vertical fold patterns, the fabric is attached to the edges of the vertical louvers or the folds are connected at the bottom edge of the panel with spacing cords or other spacing elements. An example of this type of vertical blind configuration is disclosed in U.S. Pat. No. 6,186,213, the disclosure of which is incorporated herein by reference.

Decorative fabric panels are made into curtains or drapes with individually spaced, hand- or machine-formed pleats (common referred to as "pinch pleats") at the top or heading, which create elongated vertical folds in the panel. To impart the required heading stiffness, the top of the panel is typically double-folded before pleating and a buckram or other type stiffener is inserted into the pocket defined by the double-fold. To stabilize the bottom edge of the panel, the edge is double-folded and often connected with spacer cords or other spacing devices for a uniform appearance.

A problem with the foregoing methods of imparting rigidity or stiffness to the edge areas of decorative hanging panels is the additional processing and production steps, such as for example folding, sewing, bonding, inserting materials, heat or ultrasonic sealing, which are required to achieve the desired effect. These steps are in addition to the standard textile fabrication process steps performed in a loom, a warp knitting machine or another web producing equipment, thus substantially increasing the complexity and cost of production of hanging panels. Furthermore, additional production steps increase the possibility of defects and failures such as puckering, color changes, and differential shrinkage of dissimilar materials, which result in unsightly appearances. In addition, extra materials as stiffeners, adhesives, yarns etc. are required. Special equipment for sewing, ironing, laminating and the expertise for operating such equipment also add to the overhead production expenses.

A possible approach to reducing the additional manufacturing steps and materials required to impart the necessary support edge stability is to incorporate stiffer yarns or threads, such as monofilaments or tightly twisted yarns and threads, into the edge areas. However the structure, shape, thickness and stiffness of such alternate yarns are different from the otherwise used base yarn and may thus cause web failure and interruptions in the production process, or may require specialized production techniques for insertion of the stiffer yarns where desired, and the stiffer yarns may not match the appearance of the base yarns, producing a finished fabric that is not aesthetically pleasing. An alternate approach is to increase the density, the number of yarns per area, of base yarn threads in the support edge areas. Such an approach provides only a limited increase in stiffness, and the maximum number of yarns able to be added will be limited by the capacity of the textile machine. Exceeding this capacity or running for an extended time at capacity will cause failures in the web and interruptions in the production process.

It can therefore be appreciated that a need exists for an improved decorative hanging panel and a method and system for producing the same that addresses the foregoing problems associated with imparting rigidity to the support edges of the hanging panels. In addition, it is also desirable in many circumstances to impart stiffened regions

to a lower edge, side edges or within the interior of the fabric panel. The present invention addresses such a need.

## SUMMARY OF THE INVENTION

The invention comprises in general a woven, knitted or otherwise manufactured fabric panel of base yarns laid down in an intersecting pattern, wherein the fabric panel is structured primarily for use as a decorative hanging panel to cover an architectural opening. The invention further comprises the method of manufacturing such panels. The fabric panels are provided with integrated stiffened areas at or adjacent one or more edges, or also horizontally or vertically within the body of the panel for decorative or additional support purposes, wherein the stiffened areas are made by interweaving or inter-knitting stiffener yarns into those areas. The stiffener yarns are comprised of the combination of individual elongated filaments of the same or similar material as the base yarns (to be referred to herein as common polymer filaments) and individual elongated filaments composed of a relatively low melt temperature polymer, whereby the melt temperature of the low melt temperature polymer filaments is significantly lower than the melt temperature of the common polymer filaments, and are preferably produced by twisting and entangling the two distinct filament types in known manner to form the stiffener yarns.

The low melt temperature polymer filament component of the stiffener yarn is preferably chosen such that it will melt, or significantly plasticize to the extent that bonding will occur, below the temperature encountered in the usual heat setting process for such fabrics performed in a tenter frame, which is typically approximately 180 degrees C. When the low melt temperature polymer filament component of the stiffener yarn melts or softens in the tenter frame process and then re-hardens once the fabric is cooled, it bonds the base yarn filament components within the stiffener yarns to each other and also bonds the stiffener yarns themselves to the crossing base yarns of the fabric, such that an integral stiffened area is produced that is more rigid than the remainder of the fabric panel.

The components of the stiffener yarn are chosen such that the handling characteristics differ only insignificantly from that of the base yarn, and since the

stiffener yarn remains flexible prior to the heat treatment process, the weaving or knitting process is not adversely affected. The amount of rigidity imparted to the stiffened area may be varied by altering the density of stiffener yarns relative to the base yarns, such as by alternating or otherwise interspacing base yarns in varying ratios with the stiffener yarns, or by varying the blend ratios of the low melt temperature and common polymer filament components in the individual stiffener yarns.

The stiffened area is especially useful as a support header on a decorative hanging panel, as the header can be formed in the initial fabric panel manufacturing process without requiring additional processing steps such as folding, stitching, bonding, inserting stiffener strips, or the like. The header of the invention is a simple mono-layer stiffened area as opposed to the multi-layered folded headers found in current use.

## BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself however, as well as a preferred mode of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

**Figure 1** depicts a portion of a woven fabric panel showing stiffener yarns interwoven with the base fabric yarns in accordance with a preferred embodiment of the present invention, the contrasting visual appearance of the stiffener yarns being imparted for purposes of illustration only.

**Figure 2** illustrates a cross section view of an exemplary stiffener yarn incorporated within the woven fabric panel shown in **Figure 1**, showing the combination of low melt temperature polymer filaments and common polymer filaments.

**Figure 3** depicts a perspective a view of a vertically pleated, louvered fabric panel having an upper support edge and a bottom edge stiffened in accordance with a preferred embodiment of the present invention, with the stiffened areas provide with contrasting visual appearance for purposes of illustration only.

**Figure 4** illustrates a portion of a fabric panel wherein the stiffener yarns are alternated with base yarns in an interior portion of the panel, as well as a portion where a single stiffener yarn is inserted for guide purposes, the contrasting visual appearance of the stiffener yarns being imparted for purposes of illustration only.

**Figure 5** shows the back side of a fabric panel wherein stiffened regions have been bonded, stitched, heat-sealed or otherwise joined together at spaced intervals on the panel to define rib members.

**Figure 6** shows the front side of a fabric panel wherein the stiffened regions are spaced by non-stiffened regions, such that when joined a non-rigid decorative loop is defined on the ribs.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

This invention is described in a preferred embodiment in the following description with reference to the figures. While this invention is described in terms of the best mode for achieving this invention's objectives, it will be appreciated by those skilled in the art that variations may be accomplished in view of these teachings without deviating from the spirit or scope of the present invention.

The present invention is directed to providing a means for imparting stabilizing rigidity or stiffness to the support edge area of a decorative hanging fabric panel, to other edges of the fabric panel, or to chosen horizontal or vertical interior sections of the panel, without the need for additional or specialized textile processing steps or equipment. The stiffened areas are produced during the initial fabric panel manufacturing process, such that post-manufacturing steps such as folding, bonding, stitching, inserting stiffener members or the like are not required to create the stiffened area. For purposes herein, the yarns comprising the substantially major portion of the fabric panel are referred to as base yarns, and the term yarns shall be taken herein to be composed of filaments and to encompass spun strands as well as threads made by twisting strands of yarn into a string-like length of material, or any other common fabrication technique. A specialized stiffener yarn is integrated by a weaving or knitting step into the panel support edge or other desired areas, such that the stiffener yarns intersect the base yarns across certain portions of the fabric panel. The stiffener yarns incorporate a combination of common polymer filaments, i.e., filaments composed of the same material as the base yarns or of a material having similar handling and processing characteristics as the base yarns, and heat-activated, low melt temperature filaments that increase the rigidity or stiffness of the fabric panel in the areas in which they are incorporated upon melting and subsequent re-hardening. The presence of the common polymer filaments in the stiffener yarn presents a similar visible appearance to the base yarns in the finished fabric panel, imparts handling and processing characteristics similar to the base yarns during manufacture and treatment, and provides stability and integrity to the stiffener yarn by acting as a

framework for the melted low melt temperature filaments prior to re-hardening, thereby preventing distortion during the melt process by controlling and directing flow such that the flow will not be random or excessive.

For fabric panels woven on a loom the stiffener yarn is interwoven as warp members for edge stiffened areas (i.e., laid out in the machine direction, since the panels are typically made by "railroading" or turning by 90 degrees the fabric expelled from the loom, such that the sidehem or side edge of the fabric length becomes a top or bottom edge of a finished panel), while for knitted fabric panels the stiffener yarn is integrated into the base yarn as weft members for edge stiffened areas (i.e., laid out across the machine direction). To impart vertical or horizontal stiffened stripes or other stiffened internal sections, the stiffener yarns will be integrated either as warp or weft members as required.

As explained in further detail with reference to the figures, a hanging fabric panel is provided with a stiffened or stabilized area, typically along its top and/or bottom edge but also possibly within internal regions, by interweaving or inter-knitting a plurality of the stiffener yarns into the specified region of the fabric panel during the fabrication process. The stiffener yarn comprises a combination of polymer filaments manufactured in known manner. One set of polymer filaments integrated within the stiffener yarn, referred to herein as common polymer filaments, have a relatively high melting point, typically equal to or greater than 250° C, and are preferably identical or very similar in physical properties to the base yarns comprising the fabric panel, and most preferably comprise the identical material forming the base yarns. In accordance with the present invention, the other set of polymer filaments in the stiffener yarn has a relatively low melting point and a low melt viscosity with respect to the melting point of the common polymer filaments and base yarns, preferably about 150° C or less. Such temperature is below the temperature to be encountered in a standard tentering operation. The filament components are chosen such that, prior to being heat activated, the stiffener yarns are similar in thickness and handling characteristics to the base yarns, such that it is readily woven or knitted by standard fabrication equipment without need for special adjustments. During the standard heat setting process in a tenter frame, which is equipment that

straightens and heatsets the yarns of the fabric panel by applying tension and heat, typically at approximately 180° C, the low melt temperature polymer filaments in the stiffener yarn melt and flow into the adjacent and surrounding common polymer filaments of the stiffener yarns, as well as melting into contact with the intersecting or adjacent base yarns. The concept of melt and flow does not require liquification of the low melt temperature polymer filaments, but is also to be taken herein as including by definition significant softening or plastification to the point that sufficient bonding will occur during and after the tentering process with the common polymer filaments and any contacted base yarns. The common polymer filaments of the stiffener yarns, being chosen such they do not melt at this temperature, remain intact and stable, thereby providing a framework or matrix to direct and control the flow of the melted polymer material. Thus the common polymer filaments retain the elongated yarn configuration and structure to provide stability to the panel and to prevent undesirable distortion during the tentering process. Upon cooling, the low melt temperature filaments of the stiffener yarns rigidify such that the area of the fabric panel containing the stiffener yarns is imparted with the desired rigidity or stiffness in order to increase structural strength, to stabilize the fabric weave, and to prevent distortions and unsightly disruptions in appearance.

With reference now to the figures, wherein like reference numerals refer to like and corresponding parts throughout, and in particular with reference to **Figure 1**, there is depicted a portion of a woven fabric panel showing stiffener yarns interwoven with the base yarns to create a fabric panel in accordance with a preferred embodiment of the present invention. Specifically, a fabric panel or web **5** is depicted as including a support edge region or stiffened area **7** bounding a body region **11**, only a portion of which is shown for clarity. Standard textile fabrication and processing equipment is utilized to interweave or inter-knit a plurality of stiffener yarns **1** with a plurality of base yarns **2**. The stiffener yarns **1** may be interwoven or inter-knitted in either the weft or warp direction as required by the fabrication equipment and as determined by the desired orientation of the stiffened area **7** in the finished panel **5**, with the stiffener yarns **1** usually being woven as warp threads and knitted as weft threads where edge support is desired. Typically the stiffened area **7** in which stiffener yarns **1** are incorporated is to be

the top horizontal edge from which fabric panel **5** is to be hung from a support rod, pole or similar device. As previously noted, however, stiffener yarns **1** may be integrated into other edge regions such as along the bottom edge of fabric panel **5**, as shown in **Figure 3** or even into interior regions of fabric panel **5** if desired, as shown in **Figure 4**, without departing from the spirit or scope of the present invention.

With reference to **Figure 2**, there is illustrated a cross-sectional view of an exemplary stiffener yarn **1** incorporated within the fabric panel **5** shown in **Figure 1**, the overall generally circular cross-sectional configuration being represented by the dashed lines. Each of stiffener yarns **1** comprises a plurality of individual elongated filaments, which are mutually mixed, intertwined, wrapped, air-texturized or entangled in known manner to form an elongated yarn member. As shown in **Figure 2**, the two fundamental constituent filament types incorporated within stiffener yarns **1** are common polymer filaments **9** and low melt temperature filaments **8**. The common polymer filaments **9** and the low melt temperature filaments **8** independent of each, not being bonded or attached, such that relative movement between the two types of filaments remains possible such that the stiffener yarn **1** is relatively flexible during the weaving or knitting process. Common polymer filaments **9** are preferably standard textile polymer filaments used in conventional fabric manufacture having a melting point higher than the temperatures to which the fabric is subjected during the tentering process, such as for example a polyester with a relatively high melt point of 250° C (480° F). Most preferably, the common polymer filaments **9** are composed of the same or similar material composing the base yarns **2**, such that the physical characteristics of the base yarns **2** and the stiffener yarns **1** will be similar in regard to manufacturing, processing, visual appearance and care. The low melt temperature filaments **8** are polymer filaments having a melting point below the temperatures to which the fabric is subjected during the tentering step for straightening the warp and weft yarns within the required tolerance for a given weave, which is typically performed at about 180 degrees C. In a preferred embodiment, low melt temperature polymer filaments **8** are polyester filaments having a melting point of approximately 150° C (300° F). Prior to the tentering step, the stiffener yarns **1** preferably exhibit structural and performance characteristics, such as diameter and flexibility, that are similar to the base yarns **2**, thus enabling fabric panel **5** to be

fabricated utilizing conventional textile manufacturing devices. In this manner, stiffener yarns **1** may be seamlessly integrated into the conventional textile fabrication process and, as explained below, subsequently provide a heat activated stiffening mechanism.

After the fabric is produced in the weaving or knitting equipment, it is subjected to a tentering process. During the tensioning and heat treatment process within the tenter frame, which typically is performed for about 40 to 60 seconds, the fabric panel **5** is heated to a temperature above the melting point of the low melt temperature filaments **8**, which then melt and flow about the common polymer filaments **9** within the stiffener yarns **1**, or sufficiently soften such that the tensioning effects of the tenter frame create extensive areas of contact for bonding to the common polymer filaments **9**, the common polymer filaments **9** remaining dimensionally intact such that the panel **5** is not excessively distorted by the tensioning action and providing a matrix to support the melted polymer material to prevent random or excessive flow. The melted low melt temperature filaments **9** also flows onto or has increased contact with the base yarns **2** contacting the stiffener yarns **1** in an intersecting or adjacent orientation. When subsequently cooled below the melting point of the low melt temperature filaments **8** upon removal from the tenter frame, the melted or softened polymer material from low melt temperature filaments **8** solidifies around, between and across the immersed common polymer filaments **9** to impart an increased amount of rigidity to the stiffener yarns **1** in comparison to their pre-melted state. In addition, the melted polymer material from low melt temperature filaments **8** solidifies and binds the base yarns **2** at the points of contact. This combination of increased stiffness in the individual stiffener yarns **1** and bonded points of intersection or contact between the stiffener yarns **1** and the base yarns **2** results in a significantly more rigid stiffened area **7**, whether along a panel edge or at locations internal to the panel **5**.

Since tentering processes are conventionally utilized in the manufacture of most fabric panels **5**, the present invention enables seamless incorporation of the stiffening of support edge area **7** into an otherwise conventional textile processing cycle without the need to interrupt or add addition steps to the process. The procedure is also successful with blended webs of synthetics and natural fibers. Furthermore, due to the completely

bonded web texture, stiffened areas **7** can be subsequently cut without fraying and the need for hemming is eliminated.

The resultant stiffness of support edge or other stiffened area **7** can be reduced by alternating base yarns **2** and stiffener yarns **1** in a chosen ratio to achieve a desired level of rigidity, as illustrated in **Figure 4**. The stiffness may also be varied by altering the ratio of low melt temperature filaments **8** to common polymer filaments **9** within the individual stiffener yarns **1**. The width of the stiffened area **7** will be determined by the width in which the stiffener yarn **1** is interwoven with the base yarn **2** and **3**.

In the foregoing manner, the stiffened support edge area **7** is integrated into fabric panel **5** with an aesthetic benefit and cost saving benefit of avoiding additional production steps. Puckering and bulky appearance of layered materials, dissimilar shrinkage of inserted materials, the opening of seams and bonded folds in washing or the sagging of insufficiently stabilized edge areas in fabric panel **5** is also eliminated. The present invention enables stabilization of the bottom edge **6** of delicate decorative panels for protection and for decorative purposes as well as the heading or support edge **7**, such as shown in **Figure 3**, wherein the fabric panel **5** is shown as used with vertical louver members **4**. Furthermore, the stiffened support edge region **7** or bottom edge **6** can be cut smaller without fraying or requiring the sewing of hems, in order for example to adjust the panel to the height of the architectural opening or the requirements of the panel support element.

The use of stiffener yarns **1** to create the stiffened areas **7** is particularly useful when utilized with sheer fabric panels **5**, since the sheer materials are by their nature difficult to manufacture and work with. The stiffened areas **7** may be used to designate fold lines, stitching lines or cutting lines by placing as few as one stiffener yarn **1** in the panel **5**, as shown in **Figure 4**. A relatively wide stiffened area **7** creates a well-defined linear edge that is useful to insure that folds, stitches, or other linear processing steps are properly and easily accomplished. The stiffened areas **7** may be placed in the interior of the fabric panel **11**, folded, then stitched, bonded, heat-sealed or otherwise joined together to form ribs **14** for decorative purposes or for added structural integrity to impart

particular stiffness or to retain grommets, fasteners or the like **12** and cords **15** used to open and close the panels **5**, as shown in **Figure 5**. In **Figure 6**, non-stiffened areas are spaced between the stiffened areas **7** prior to forming the ribs **14** such that decorative flexible loops **13** are defined.

While this invention has been described in terms of several embodiments, it is contemplated that alterations, permutations, and equivalents thereof will become apparent to one of ordinary skill in the art upon reading this specification in view of the drawings supplied herewith. It is therefore intended that the invention and any claims related thereto include all such alterations, permutations, and equivalents that are encompassed by the spirit and scope of this invention.